

Grounding serious game design on scientific findings: the case of ENACT on soft skills training and assessment

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Abstract. The lack of open-access tool for the enhancement and promotion of soft skills is bringing the e-learning community to new educational challenges. The paper describes the implementation of ENACT, an online serious game for the standardised psychometric assessment and training of users' negotiation skills through the interaction with virtual artificial agents. The assessment process is divided into 8 scenarios based on real life situations and investigates the user negotiation styles in relation to Rahim's conceptualization of five different styles of handling conflict. Need analysis data and preliminary testing results of the platform are presented.

Keywords: eLearning, Technology-Enhanced Learning, serious games, simulation-based learning, psychometric assessment, negotiation, soft skills.

1 Introduction

In recent years the attention of e-learning is progressively moving from the classical view, assuming that learning involves knowledge acquisition and transfer, with a main focus on hard skills, to a more comprehensive approach that involves the domain of soft skills training. Soft skills, also commonly referred as "people skills", are personal attributes or a cluster of personal traits that contribute to how people know and manage themselves, as well as their relationships with others. They include skills such as proficiencies in the area of communication, conflict resolution and negotiation, leadership, and team building, to name a few. Today soft skills are recognized as transversal competencies existing in reciprocal relationship with hard skills, as it is testified by the numerous documents produced by the European Union about the enhancement of social and entrepreneurial skills (e.g. the Key Competences for Lifelong Learning [1]) and by the US Accreditation Board for Engineering and Technology (ABET), which is explicitly demanding the improvement of soft skills training in the IT sector [2], with a particular focus on communication and negotiation skills.

A crucial feature of soft competencies is that they can be assessed and developed through training, education and development programs. The most effective training method for soft skills development is considered to be role-playing, usually performed by trainees face-to-face, with the guidance of a professional trainer acting as facilitator. In general terms, the act of “role-playing” describes an experience in which two or more people are involved in “as-if” or simulated actions and circumstances [3] that project participants into an imaginative-creative process established through the interpretation of a real or fictional role in a specific given situation. Derived from the psychodrama and sociodrama methods introduced by Moreno [4], role-playing is an active pedagogical method to learn about social roles and interactions.

The porting of soft skills training and assessment into technology enhanced environments is relatively recent and current examples of technology-enhanced role-playing simulations are usually based on 2D or 3D chat rooms, where users can interact online by voice or text messages. In some cases they portray emotional states [5]. In other limited cases the interactions can also happen between humans and artificial agents controlled by Artificial Intelligent algorithms [6], [7].

In this paper we describe the methodology for the development of an educational tool in the form of a 3D game-based intelligent platform to assess and train the user’s negotiation and communication skills in realistic scenarios. The ENACT (Enhancing Negotiation Skills through On-Line Assessment of Competencies and Interactive Mobile Training) platform aims at crossing the boundaries between educational games and tutoring systems, merging the importance of an standardised, online user assessment with the motivating environment of serious games. Within the ENACT project *negotiation* has been identified as a crucial competence for learning and personal development, as it helps to communicate constructively in different contexts and directly affect people’s social environment. The paper will present the process of porting soft skill assessment and training from classroom to digital environments.

2 Psychological Modelling and Platform Design

The negotiation model adopted in ENACT is based on the five styles of handling interpersonal conflict proposed by Rahim [8], [9], which is the most recognised model by occupational psychologists. This model differentiates 5 styles of negotiation based upon two basic dimensions: *concern for self*, the degree (high or low) to which a person attempts to satisfy his or her own concern; and *concern for others*, the degree (high or low) to which a person attempts to satisfy the concern of others. The combination produces the following styles of conflict management: (1) *Integrating* (high concern for self and others); (2) *Obliging* (low concern for self and high concern for others); (3) *Dominating* (high concern for self and low concern for others); (4) *Avoiding* (low concern for self and others); and (5) *Compromising* (intermediate in concern for self and others).

Each style manifests itself in a pattern of observable behavioural indicators that we have identified in the communication model of assertiveness, passivity and aggression [10]. For each of the 5 styles, we have distinguished verbal, non-verbal and para-

verbal variables, grouped in the two dimensions proposed by Rahim, i.e., concern for self and for others.

The final goal of ENACT game is to return an assessment and provide training opportunities. The assessment of the player is based on the preferred negotiation styles used during a series of negotiation scenarios, based on the description of the 5 styles provided by Rahim. The assessment should be comparable to a professional assessment conducted with traditional “pen and pencil” methods (i.e. the ROCI-II questionnaire designed by Rahim [9]). Based on the assessment, the system automatically elaborates a training strategy tailored to the specific development areas of the player, in order to create an effective learner-centred environment, where the user activity is focused on the areas of behaviour that mostly require improvements.

The web platform has been designed to bring the model into a 3D virtual environment. The game is organized in scenarios, each independent from the others, where the user will play a different character and will negotiate with various virtual agents in real and everyday life situations. The main game components are the virtual agents and the interface (Fig. 1).



Fig. 1. The user interface of one scenario in the assessment mode. The foreground avatar is controlled by the computer and the avatar in the smaller windows at the top-left corner represents the player's avatar. The sentences on the left represent the choices of the player in response to the actions of the computer avatar.

The artificial agents are implemented as virtual 3D characters inside the game scenarios developed within the Unity3D framework. They interact dynamically with the user and are able to perform a range of basic expressions using verbal cues: Vocal tone and structure of the sentence; and non-verbal indicators: Facial expression, eye contact, body posture and gestures. The user character is also shown to the player, and it is represented by a 3D model inside the scenario. The sex of the characters is a variable related to the gender specified by the user at the registration, mandatory for accessing the platform. The virtual agent-user interaction is divided into states, which include one turn of speech for each party. In every state, the user can choose one

among 4 possible sentences, each of which is correlated to a gesture and/or facial expression that shows the way the sentence will be told to the agent.

The interface is designed to be as intuitive as possible. The two characters are shown on the screen along with their gestures, while the sentences are shown in bubbles over the head of the agents. When the mouse is over one of the user sentences (Fig. 1, left side), the animation related to that sentence is shown in the top-left rectangle. In order to choose a sentence, the user needs to click on it.

Two game sessions are planned: *Assessment*, where the user negotiation attitude are measured and *Training*, where the user will be individually taught about her adopted negotiation styles. The training session is still in development.

The assessment session is a game mode for the user to be assessed in a standardized way according to Rahim's model. In this session, the system collects the data about the user's behavior and choices and creates a model of the player that will then be used for generating tailored information in a subsequent training session. The assessment environment is composed by a series of 8 different scenarios that concern a negotiation situation between two peers. The virtual agent's behavior shows a specific negotiation style for each of the scenarios. The user does not get any feedback between the scenarios, and there is no right or wrong answer.

Three parameters according to which the scenarios were designed are: (i) The negotiation style adopted by the virtual agent; (b) If the player and the agent have the same or opposite gender, so the interactions can be male-male (or female-female) and male-female (or female-male); (3) If the negotiation concerns a decision about two different possibilities (divergence) or concerns a single object which must be exclusively assigned to one of the two characters (convergence).

3 Results

In order to design and develop the ENACT learning scenarios a systematic investigation and analysis of the training needs of target groups across 3 countries participating in the project has been conducted. Multiple methods of data collection have been used: (1) completion of a scoping questionnaire from 9 pivotal group target stakeholders (to gather information regarding existing training policy and practices of soft skills); (2) completion of 10 face-to-face semi-structured interviews (to identify different cultural definitions of the concept of negotiation); (3) utilisation of an online survey completed by 56 respondents (to elicit views and gain useful insights and nuanced opinions on the training needs). Results show that there is a gap between (a) recommended educational practice of national guidelines and current practice in schools and training institution about soft skills related subject; and (b) national practice guidelines of technology application and the training provided to teachers in the use of technology. Few projects and training activities have been developed for promoting the use of computer games for soft skills development, with exception of Italy that in the last decade has been forefront of innovative role-playing and simulation tools for soft skills training, e.g. [4]. Results also show that key elements related to the concept of negotiation varies between target groups and age range. In business, for

example, problem-solving and effective time management are the aspects more appreciated within negotiation. Teachers consider essential the ability to positively manage a conflict. For students, interpersonal relationships are the key for a successful negotiation. Moreover, findings from the online questionnaires have identified the relational competencies considered being more characteristic of negotiation:

- Spain: effective communication (90%), empathy (70%) decision making (65%);
- Turkey: effective communication (80%), problem solving (50%), empathy (50%) and creative thinking (50%);
- Italy: critical thinking (64%) and active listening (64%).

The platform prototype has been tested in two public occasions. The first set of data were collected at Plymouth University in September 2014. 152 subjects tested the game, of which 72 in the age 6-10. A total of 79 subjects between the age of 11 and 60 completed the questionnaire, with a mean age ≈ 20.6 , of which 41 males and 38 females. The questionnaire was made of 8 questions about the game content and interface. The first 7 items had 5 possible answers based on a 5 point Likert scale, where 1 stood for “Extremely bad” and 5 “Extremely Good”; the last question, instead, asked the participant if she would have played the game again in different scenarios. Data showed that the overall feedback was positive, the average rating for each of the question never scored below 3.5 points except for Question 2 (regarding the realism of the conversations) and 5 (about the game graphics) which scored a mean of 3.4 and 3.3. 95.3% of the subjects answered “Yes” to Question 8, showing an overall interest in the future development of the game.

Another set of data about a second prototype with the full assessment system in place were collected at Plymouth University in March 2015, where subjects were asked to play 4 different scenarios and to provide a feedback about the platform. The pool was composed of 39 people, in the age 11-28, of which 18 males and 21 females. The questionnaire was composed by 13 questions, of which 12 of them had a 5 points Likert scale as possible responses that ranged from “Totally Disagree” (represented as 1 point) to “Totally Agree” (represented as 5). All the questions asked in the previous test showed at least a slight improvement, and in this case only Question 5, about how modern the graphics look, scored less than 3.5. Two questions even scored above 4, and, in particular, the highest score was reached by Question 12, about if users had a positive experience in using ENACT game, while that same question had scored 3.9 on the previous demo. 94.7 % of the subjects answered that they would play the game again with different scenarios.

4 Conclusions

The final aim of ENACT is twofold. On one hand, it is to apply role-playing techniques in a digital context in order to obtain comparable information provided by the administration of the ROCI-II, as well as investigate possible relationships between the scores from the questionnaire about the different styles, and the styles shown by the users during the interaction with the artificial agents. This aims to provide a relia-

ble alternative to traditional psychometric assessment methodologies based on questionnaires and tests. On the other hand, it is to provide a personalised, learner-centred and protected environment, where the user can build up from the assessment and gain awareness of her own negotiation and communication in a constructive and experienced-based environment. Therefore, we are proposing a methodology that focuses on the complementarity with traditional assessment and training tools, and offers alternatives and inclusive training processes of soft skill to the often expensive assessment centres provided by professional consultancy firms.

We believe that technology can offer a new and positive model for approaching the fundamental domain that involves the personal sphere of individual, not only through well know social networks dynamics, often difficult to control, but thanks to a rational and scientific approach that tries to bridge the past to the present with modern, accessible and effective tools, that can be comparable with previous assessment and training methods. This is the case of ENACT in comparison with the ROCI-II test. We believe that the validation process which is currently in place will add a fundamental dimension to the current use of technology and serious games in education, by grounding learning analytics and player's behaviours in frameworks that are accepted and recognised by psychologists and professional trainers.

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